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hensive training, or at least from the lack of profiting by it. If while himself a student at the John Hopkins University, he had determined to get all there was in the admirable elementary courses which are there offered in general biography, zoölogy, animal physiology and embryology, instead of interesting himself from the first mainly in plants, he would not only have been enabled to take a broader view of his specialty, but would not have committed himself to the position in which this article places him.

Mr. MacMillan incidentally remarks that he has "not at present time to discuss the fundamental absurdity of courses in 'general biology,' as if it were possible to plunge boldly into comparative study of plants and animals before one has studied plants and animals themselves. It is as if one should enter upon analytical statics and follow it up by geometry and the calculus." Here again Mr. MacMillan demonstrates the urgent need of a good course in general biology for botanists as well as for zoölogists. Here the analogy drawn is false. Zoölogy and botany do not bear a similar relation to biology that geometry and the calculus bear to the higher mathematics. The instruments for solving problems in botany and zoölogy are essentially the same, such as good observation, sound reasoning, a knowledge of technical methods, and of the other physical sciences.

It is not necessary for the student to examine a large number of organisms in order to come face to face with the fundamental properties of living things, and this fact proves that Huxley and his successors are right in insisting that the study of biology is one discipline. To teach the student this, and to lead him to discover some of the wider agreements and differences of living organisms, is of more intellectual value to him than to conduct him at the start to the more special study of either plants or animals. This is true whether he is to become a specialist in biology or not.

Some of the chief merits of Mr. MacMillan's paper have now been pointed out. A subordinate merit which it possesses is that of calling attention to the defect in many institutions of not including botany in their curriculum, or in not giving it the prominence which it deserves. If he had limited himself to pointing out this defect, without casting slurs upon honored institutions and their graduates, in an offensive way, his article might have done good. FRANCIS H. HERRICK.

Adelbert College, Cleveland, Ohio, April 15th, 1893.

A New Source of the So-Called Mexican Onyx.

LOVERS of the beautiful, in the way of high-grade material for decorative work, will be pleased to learn of the recent discovery, on the peninsula of Lower California, of extensive deposits of the so-called Mexican onyx. The new find is some 150 miles southeast of San Diego, and 50 miles from the Pacific coast. The material, as is the case with that of Mexico proper and other sources, is a travertine (i.e., a spring deposit) and not stalagmitic. The deposits are essentially superficial, the material in many instances so occurring as to be taken directly from the surface of the ground by means of bars and without previous stripping. The colors are light green, rose, and white, variously veined and tinted, and of great beauty, while in compactness of texture, susceptibility to polish and freedom from flaws, the material leaves little to be desired. A company has already been organized for working the deposits, and the first shipment has reached St. Louis, to be cut and polished for exhibition at Chicago during the World's Columbian Exhibition. GEORGE P. MERRILL.

Washington, D.C.

BOOK-REVIEWS.

The Metaspermæ of the Minnesota Valley. A list of the higher seed-producing plants indigenous to the drainage basin of the Minnesota River. By CONWAY MACMILLAN. Minneapolis, 1892. 839 pp. 2 Maps. 8°.

BOTANISTS will examine this volume with interest, because of the numerous new features it presents. It is the first of the botanical reports of the Geological and Natural History Survey of Minnesota, and, while entirely local in its character, it is very far beyond the usual local catalogue. It contains a record of 1,174 species and varieties, distributed among 407 genera and 106 families. Under each family reference is made to the place of its original characterization, the number of genera and species, living or extinct, it contains, and its distribution in a very general way. Under each genus we have the synonomy as fully as may be, again with a reference to the number of species and their more detailed distribution. Finally, under each species and variety the synonomy is given, still more detailed distribution, and mention of herbaria where specimens are to be found. It will thus be seen that, while it is a catalogue of plants, it is one in a wider sense than the majority of such publications. Its interest and value to botanists lie not alone in the various facts above referred to, but because it discards the time-honored arrangement of orders, such as is found in the ordinary manuals and text-books, and introduces the newer and more natural system of classification. It contains, besides, a discussion of the factors upon which classification is based, principles of geographical distribution, and extraordinary statistical detail respecting the plants named in the list.

We turn first to the classification and nomenclature. We well recollect when we first began to study botany, the feeling of satisfaction that was felt at the seeming stability of the science. We had been familiar with the discussions of zoölogists and geologists regarding the condition of nomenclature in their respective branches, and the botanical manuals gave no sign of changes that were to come, or indicated the presence of dangerous ground. But rumblings of the coming eruption were soon heard, although it was not until the publication of that amazing book of Kuntze's, "Revisio genera plantarum," which has turned everything upside down and set the whole botanical world by the ears, that the full violence of the eruption was realized. Against many of the suggestions of this reformer there has been open revolt, but upon the whole the effect has been good. It is true it has compelled those who learned their botany some years ago to learn much of it over again, and has made our latest text-books obsolete or old-fashioned, but it has also put the science upon a more stable foundation.

The discussion of generic and specific names has introduced the perennially fertile subject, a natural classification of orders. The plan of placing Ranunculaceæ at the head of Anthophyta and Gramineæ at the foot is so familiar that scarcely any other seems possible. It has been recognized, however, that the system was very faulty, and numerous endeavors have been made to change it. As long ago as 1883 the present writer, in an article entitled "On the Position of the Compositæ and Orchideæ in the Natural System,"[1] pointed out that the old arrangement was far from being the best; and he made some suggestions as to what families should take the highest rank. He suggested that among dicotyledons Compositæ should be regarded as the highest, inasmuch as here is found the largest production of seed (the end of all plant life) with the least expenditure of material, and, at the same time, with ample provision for cross fertilization. The immense number of species and their great range were also cited to prove their high position. The impossibility of arranging the orders in a strictly natural and yet lineal system was recognized, but it was suggested that the Labiatæ were somewhat parallel with the Compositæ in their differentiation; while with that order were associated, as near allies, Verbenaceæ, Boragineæ, and Scrophularinæ. Among polypetalous orders Leguminosæ was placed highest, followed closely by Rosaceæ, Saxifragaceæ, Umbelliferæ, and Ranunculaceæ. Among monocotyledons the Orchideæ were accorded the highest rank, mainly because of their large numbers, wide distribution, varied form, and elaborate means for cross fertilization. At the same time, a general scheme was proposed, which is reproduced here. In it, it will be observed that there are four general lines of descent, viz., from Orchideæ, Liliaceæ, Palmæ, and Gramineæ. The relative rank of the smaller orders is not that which has been followed in the volume under review, but the

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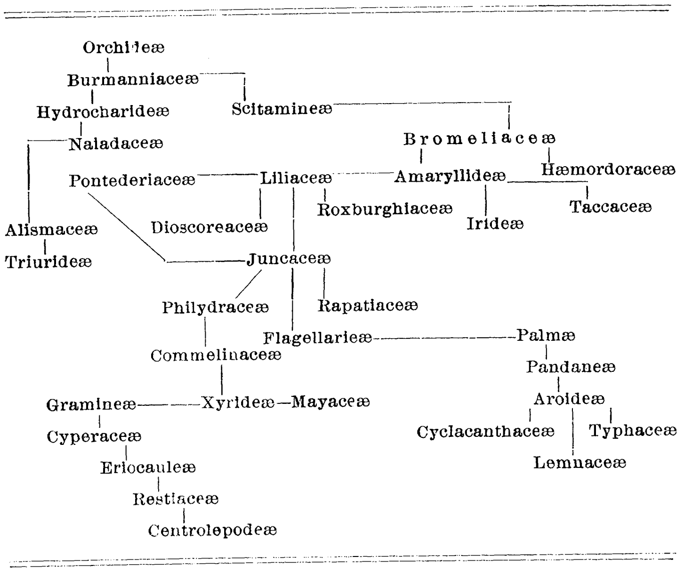
[1] American Naturalist, December, 1883. Also read in the Minneapolis meeting of the A. A. A. S.

Chart of the Monocotyledons.



placing of Orchideæ at the head of one alliance, and Gramineæ of another, agrees with the general scheme. Again, among the dicotyledons Compositæ is regarded as the highest and Ranunculaceæ is placed well down in the scale. The whole arrangement is that of Engler and Prantl,[2] but it corresponds so well with the provisional outline suggested by the writer of this that he has called attention to it.

Professor MacMillan's plan in the citation of authorities is in all cases to preserve the original specific name, *except* when this is the same as the genus, when the next oldest name is substituted. This is in accordance with the rules adopted by the botanists of the American Association for the Advancement of Science. All may not agree to this exception, but to the present writer it seems the better plan. Another feature, more or less of an innovation in botany, is to use lower-case letters instead of capitals in all specific names, no matter what the source from which they have been derived. This is the plan adopted in some of the other sciences, notably in paleontology, and it is being rapidly adopted by botanists.

Inasmuch as the old divisions of the Dicotyledons — Polypetalæ, Gamopetalæ, and Apetalæ — have been discarded, a new series of terms is needed, and those adopted in the volume are as follows: —

Division A. — Protophyta.
Division B. — Metaphyta.

Plants where sexuality has not been (A) or where it has been developed (B). Under B we have: —

(I.) Gamophyta, which develop sexual plants from their eggs without any spore-producing structure intervening, such as pond scums, black mold, and algæ like *Œdogonium;* and

(II.) Sporophyta, in which the fertilized egg is divided into a cellular structure capable of growth, and consists of a spore from which sexual plants are produced.

Then comes the division of (II.) into (1) Thallophyta, (2) Archegoniata, and (3) Metaspermæ. In (1) are included the great mass of sea-weeds, algæ, and fungi. In (2) we have Chara, Nitella, coniferous trees, the extinct Lepidodendron, etc., and in (3) we have those forms producing seeds in a closed ovary. Finally the Metaspermæ are divided into two groups: (*a*) Archichalydeæ, without a perianth or having one made up of separate leaves, about equal to the old groups Apetalæ and Polypetalæ, and (*b*) Metachlamydeæ, in which the perianth leaves are united, and

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[2] Natur. Pflanzenfam , 1887–1893.

CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

April 18. — J. Owen Dorsey, Siouan Phonetic Types; James Mooney, The Indian Messiah and the Ghost Dance (illustrated by Lantern Slides); Henry Gannett, Estimates of Wealth.

Society of Natural History, Boston.

April 19. — J. B. Woodworth, Traces of a Fauna in the Cambridge Slates; Charles P. Bowditch, Ruins of Central America.

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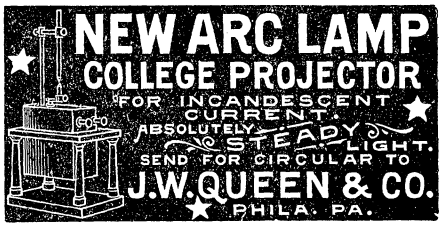
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which equals the old group Gamopetalæ. The classification may be tabulated as follows:—

- A.— Protophyta.
- B.— Metaphyta.
  - I. Gamophyta.
  - II. Sporophyta.
    - (1) Thallophyta.
    - (2) Archegoniatæ.
    - (3) Metaspermæ.
      - *a.* Chalazagameæ (a single genus *Casuarina*).
      - *b.* Porogameæ.
        - * Monocotyledons.
        - ** Dicotyledons.
          - † Archichlamydeæ.
          - †† Metachlamydeæ.

While following the classification of Engler and Prantl to a large extent, Professor MacMillan takes issue with them upon some points. One of these is the nature of the Mycetozoa, or, as they are more commonly called, Myxomycetes. He believes them to be animals rather than plants. It is difficult for the present writer to see why the motility of the plasmodium of these plants, really the only animal-like feature they possess, should be regarded as very different in character from the motility of the swarm-spores of such universally recognized plants as *Hydrodictyon, Œdogonium, Volvox*, and others. If motility in conjunction with lack of chlorophyll be evidence of the animal nature of the Myxomycetes, why should not the stationary *Hydra*, multiplying (as it can) when cut into small pieces, and possessing chlorophyll, be considered a plant? Or where are we to place *Dionœa, Drosera*, and the like, that present movements analogous to, if not precisely the same as, the contractile powers of many animals? The hard and fast lines between the animal and the vegetable kingdoms have long since been broken down, and there is as much justice in placing Myxomycetes with vegetables as in placing Protista with animals. The fact of motility, the absence of chlorophyll, or both combined, can scarcely be sufficient to overbalance the preponderance of facts showing the distinct vegetable nature of the slime-molds.

There is a long and interesting discussion of the relationships of the metasperic flora of the region, in which the general features of geographical distribution and the factors concerned with it are considered. The history of the region is regarded as of prime importance, and past time has been a most potent factor in the work. As the Metaspermæ have existed on the earth since as far back as Jurassic times, this history begins then. Glacial time, however, was the period most immediately concerned with the present distribution. Many plants previous to that epoch lived in Minnesota which were driven away never to return, or which were entirely exterminated; while, on the other hand, many species were found after the close of the period entirely unknown before. The Sequoias, once widely spread over the continent, but now occupying so restricted a range, he considers to be an indication of the great competition existing between plants in Tertiary times, their great height and giant bulk showing the magnitude of the struggle. So, on the other hand, the Compositæ are regarded as representing a type that permitted wonderful variation, and hence great adaptability to changed conditions.

The 150 pages devoted to statistics of the flora can only be mentioned here. Even a detailed statement of the heads treated of would give but a faint idea of the elaborateness of the discussion. A very full index (66 pages) gives easy reference to all species, genera, and orders mentioned. Altogether this is the most elaborate catalogue of plants of a limited district it has ever been our lot to examine. Its use of modern classification and nomenclature will make it of very great interest and value to all systematic botanists, and, while all may not agree with the author in his many suggestions or innovations, there are none but will recognize the enormous amount of labor put into the volume. It is greatly to be desired that other limited floras be as completely dissected and discussed.

JOSEPH F. JAMES.

Washington, D.C., March 27.

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